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HISTORY AND GEOGRAPHIC DISTRIBUTION OF *Cucurbita pepo* GOURDS IN FLORIDA

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ABSTRACT.—Page-Ladson, a Florida wet site, has yielded *Cucurbita pepo* gourd seeds that date to the Pleistocene-Holocene transition. One sample with gourd seeds has accelerator radiocarbon dates of 12,545 ± 80 B.P. and 12,375 ± 75 B.P. (NSF-Arizona AMS lab, AA-7452 AA-7453). A gourd seed from a deeper stratum was directly dated by the accelerator method to 12,570 ± 100 B.P. (AA-8759). These records constitute the earliest for the genus *Cucurbita* from any geographic area. The Page-Ladson seeds and *Cucurbita pepo* remains from other Florida wet sites are compared; morphometric data from the combined collections indicate that all prehistoric seeds from Florida appear to be from wild gourd populations. The implications of recovering Pleistocene gourds in eastern North America are discussed, and a revised interpretation of their prehistoric distribution and cultural significance is presented.

RESUMEN.—Page-Ladson, un sitio arqueológico pantanoso en la Florida, ha proporcionado semillas del calabazo *Cucurbita pepo* que datan de la transición del pleistoceno-holoceno. Una muestra que contiene semillas de calabazo ha sido datada, a partir de carbono radiactivo mediante acelerador, a 12,545 ± 80 y 12,375 ± 75 años antes del presente (AA-7452 y AA-7453, laboratorio AMS en Arizona de la Fundación Nacional de Ciencia de los Estados Unidos de Norteamérica). Una semilla de calabazo de un estrato más profundo fue datada directamente mediante el método del acelerador a 12,570 ± 100 años antes del presente. Estos constituyen los registros más tempranos para el género en cualquier área geográfica. Se comparan las semillas de Page-Ladson y los restos de *Cucurbita pepo* de otros sitios cenagosos de la Florida; los datos morfométricos de las colecciones combinadas indican que todas las semillas prehistóricas de la Florida parecen ser de poblaciones silvestres de calabazos. Se discuten las implicaciones de los calabazos del pleistoceno en Norteamérica oriental, y se presenta una interpretación actualizada de su distribución prehistórica y su importancia cultural.

RÉSUMÉ.—Page-Ladson, un site humide de Floride, a produit des graines de courges *Cucurbita pepo* qui datent de la transition Pleistocène-Holocène. Un échantillon comprenant des graines de courges a produit des dates basées sur l'accélérateur radiocarbone de 12,545 ± 80 et 12,375 ± 75 années avant le présent (NSF-Arizona AMS lab, AA-7452, AA-7453). Une graine de courge provenant d'une couche plus profonde est datée directement par la méthode d'accélerateur à 12,570 ± 100 (AA-8759). Ce sont les données les plus anciennes pour le genre, quelque soit la region. Les graines de Page-Ladson et les restes de *Cucurbita pepo* provenant d'autres sites humides de Floride sont comparés; des données morphométriques obtenues sur les collections combinées indiquent que toutes les graines préhistoriques de Floride semblent provenir de populations de courges sauvages. Une discussion concernant les implications presentées par la présence de courges datant du Pleistocene dans l'est de l'Amérique du Nord est inclue, ainsi qu'une révision de l'interprétation de leur répartition préhistorique et de leur valeur culturelle.

INTRODUCTION

Florida's wet sites are famous for their exceptional preservation of soft organic materials, including human brain tissue, woven fabric, wooden artifacts, and abundant plant structures (Coles and Coles 1989; Doran and Dickel 1988; MacDonald and Purdy 1982; Purdy 1988, 1991). Gourd remains, including bottle gourd *(Lagenaria siceraria)* and *Cucurbita* gourd *(Cucurbita pepo),* have been recovered from waterlogged deposits at several Florida sites. *Cucurbita* seeds and rind are known also from a few terrestrial excavations. Previously reported Florida archaeological contexts with *Cucurbita* gourds and other Cucurbitaceae range in age from at least 7000 years ago through the Spanish Mission Period that ended in the eighteenth century (Cutler 1975; Decker and Newsom 1988; Denson et al. 1992; Doran et al. 1990; Milanich and Fairbanks 1980:118; Mitchem and Hutchinson 1987; Newsom 1987, 1991, 1993; Newsom and Decker 1986; Newsom and Quitmyer 1992; Russo et al. 1992; Scarry 1985, 1991a, 1991b; Scarry and Newsom 1992).

Recent excavations at the Page-Ladson (8Je591) Site in the lower Aucilla River add another to the list of Florida sites with *Cucurbita* gourd remains. Deposits at Page-Ladson range in date from the Wisconsin glacial maximum, approximately 18,000 years ago, to around 4000 B.P. Lithic, bone, and wooden artifacts from the late PaleoIndian and Archaic periods appear in terminal Pleistocene, early Holocene, and more recent strata (Dunbar et al. 1990).

Cucurbita pepo seeds were recovered from a series of strata encountered in separate excavation units at Page-Ladson. These strata also contain extinct Pleistocene megafauna, including horses (*Equus* sp.) and American mastodon *(Mammut americanum).* Evidence of human activity from some of the same general strata is present, but scant. One sample (F.S. 131) with gourd seeds has accelerator radiocarbon dates of 12,545 ± 80 B.P. and 12,375 ± 75 B.P. (NSF-Arizona AMS lab, AA-7452, AA-7453). A *Cucurbita* seed from the deepest excavation level (level 26B) of Test F was directly dated by the accelerator method, producing a date of 12,570 ± 100 B.P. (NSF-Arizona AMS lab AA-8759). With one exception, *Cucurbita pepo* seeds have currently not been documented in more recent Holocene-aged deposits at Page-Ladson.

In this paper we describe the Page-Ladson *Cucurbita pepo* seeds and the depositional contexts from which they were recovered. The Page-Ladson seeds are then compared with *Cucurbita pepo* seeds from other archaeological localities in Florida.

We outline a reconstruction of the antiquity and geographic distribution of *Cucurbita pepo* in Florida, incorporating the new data. We employ a biogeographic perspective to explain the Pleistocene *Cucurbita* gourd occurrence in the eastern United States. Finally, we discuss the hypothesis formulated by Smith et al. (1992) and others that an indigenous, eastern wild *Cucurbita* gourd was present in North America as early or earlier than archaeologically-documented Mesoamerican relatives as a new way to elucidate the controversial history of gourd use in North America.

PAGE-LADSON (8JE591)

Location and riverine environment.—The Page-Ladson site occurs below the surface of the Aucilla River in a section of the river known as Half-Mile Rise (Fig. 1). Like most of the lower Aucilla River, Half-Mile Rise consists of a string of deeper segments representing sediment-filled sinkholes connected by shallower links; the river rises from one sinkhole, courses half a mile, and then disappears into another sinkhole. The site is located within one of the large, partly eroded sinkhole depressions.

Many features of the Page-Ladson site derive from its history as a coastal sinkhole in limestone (karst) terrain during the late glacial rise of sea level (Brooks 1967; Vernon 1951). During the late Pleistocene, backfilling sinkholes appeared as deep, isolated freshwater ponds (cenotes) surrounded by well-drained limestone terrain. Under the more arid conditions of the late Pleistocene in Florida (Watts and Hansen 1988), sinkhole ponds were an important source of fresh water.

Flowing water has removed large volumes of sediment from sinkholes in the river course and also has destroyed some of their defining limestone walls. Fortunately, the relatively deep erosion of the river channel through the sediments of the main sinkhole at Page-Ladson did not remove the portion along the west bank, where more than five meters of sediments record the late Pleistocene and early Holocene history of the area.

Page-Ladson deposition and gourd-bearing contexts.—Nine excavations of various proportions have been conducted at Page-Ladson, beginning in 1983. Excavation units that penetrate deeply enough reach a discontinuous, late Pleistocene reddish-brown peat stratum. Near the center of the main Page-Ladson sinkhole we encountered the oldest sediments consisting of buried peat that produced a radiocarbon date of 18,430 ± 220 B.P. (Dunbar et al. 1990). The next units encountered are 0.5–1.0m thick calcareous sand lenses that overlie and intergrade with the red-brown peat.

The red-brown peat and the associated calcarenite deposits frequently contain late Pleistocene vertebrates. During the most recent excavation at Page-Ladson (1991 Test F, Level 26B) a proboscidean (mastodon, mammoth) skull was uncovered with its tusks and lower portions buried in the red-brown peat and the cranium extending into the overlying calcareous sand. One *Cucurbita pepo* seed was found in the red-brown peat that filled the eye orbit of the skull. This particular gourd seed was dated by the accelerator radiocarbon method; the resulting date of 12,570 ± 100 B.P. (AA-8750) was mentioned earlier. This seed establishes the earliest date for *Cucurbita pepo* at Page-Ladson.

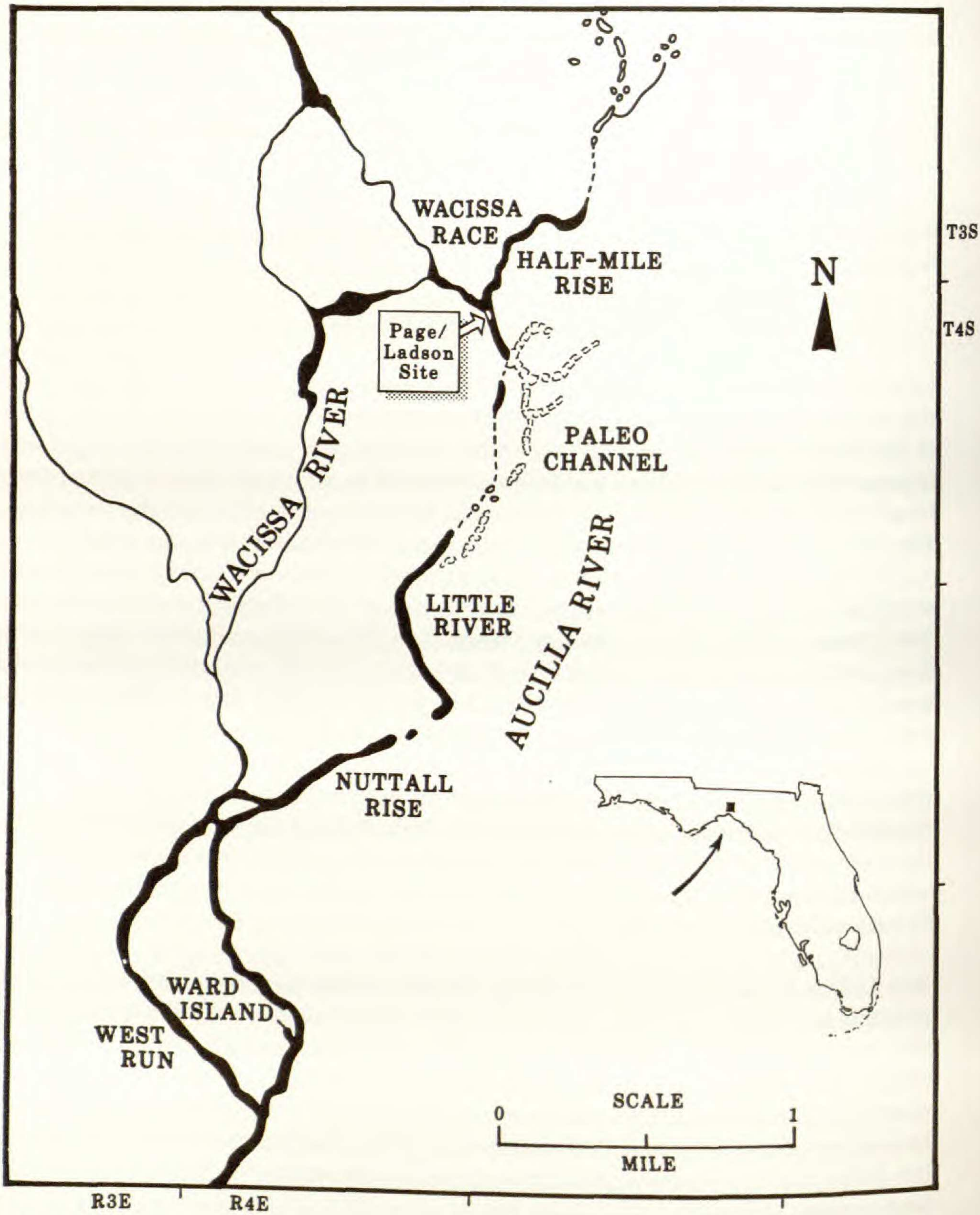

FIG 1.—Location of the Page-Ladson (8Je591) site in northwest Florida.

The calcareous deposits described above are capped in several places by a highly organic clay stratum (Levels 16–22, 1991 unit). Some pockets of organic clay occur also within the calcarenites, and, similarly, as isolated pockets of material overlying the primary organic clay concentration of Level 20B in the Test F excavation. The organic clay deposits are coarse in texture due to an abundance of loosely consolidated masses of woody fiber, twigs, and small stems. Lengths of these

TABLE 1.—Radiocarbon dates for Page-Ladson (8Je591), Florida. (see also Dunbar et al. 1990)

Age	Test	Sample/stratum
3440 ± 70 B.P. (Beta)	B	bottom of ceramic-bearing deposit
4070 ± 60 B.P. (Beta)	B	land bridge collapse (fluviation)
8905 ± 65 B.P. (Ariz.)	C	wood stake from above "Bolen floor"
9450 ± 100 B.P. (Beta)	B	clay with mulberry wood remains
9730 ± 120 B.P. (Beta)	B	"Bolen-beveled" horizon
10,000 ± 120 B.P. (Beta)	C	"Bolen floor"
10,280 ± 110 B.P. (Beta)	C	"Bolen floor"
10,600 ± 70 B.P. (Beta)	C	upper colluvium, calcarenite deposits
10,520 ± 90 B.P. (Beta)	A	proboscidean bone in upper calcarenite
11,770 ± 90 B.P. (Beta)	A	upper calcarenite
11,790 ± 90 B.P. (Beta)	C	calcarenite deposits
12,240 ± 90 B.P. (Beta)	C	bottom of core in unit, calcarenite deposits
12,330 ± 110 B.P. (Beta)	B	calcarenite deposit
12,375 ± 75 B.P. (Ariz.AMS)	C	FS 131[1] *Cephalanthus* twig, woody-organic clay
12,545 ± 80 B.P. (Ariz.AMS)	C	FS 131[1] *Vitis* seed, woody-organic clay
12,570 ± 200 B.P. (Teled.)	A	upper calcarenite
12,570 ± 100 B.P. (Ariz.AMS)	F	lower calcarenite/red-brown peat (*Cucurbita* seed)[1]
14,600 ± 115 B.P. (Ariz.)	C	lower peat deposit
18,430 ± 220 B.P. (Beta)	E	"cypress-forest" peat

[1]Sample with *Cucurbita*-gourd seeds.

fragments in one sample that has been intensively studied are strongly modal at 7–10 mm. We suggest elsewhere (Webb and Newsom 1991) that at least some of this material may represent proboscidean, specifically mastodon *(Mammut americanum)*, dung. Two *Cucurbita pepo* seeds were recovered with a sample of hypothesized mastodon digesta, F.S. 131 from the 1988 excavation. Additional *Cucurbita pepo* seeds were recovered from similar deposits in Test F (Levels 14–25, see below). Accelerator radiocarbon dates on a buttonbush twig and a grape seed from F.S. 131 are 12,545 ± 80 B.P. (AA-7452) and 12,375 ± 75 B.P. (AA-7753), respectively (Table 1).

Remains of proboscidea and other extinct Pleistocene fauna appear in the red-brown peat, calcarenite, and woody organic clay deposits. Evidence at Page-Ladson of a direct association between early humans and Pleistocene fauna (and therefore also humans and Pleistocene-aged deposits that include *Cucurbita* gourd seeds) is limited, but not entirely absent. Worked ivory shafts and other specimens of humanly-modified megafaunal remains have been recovered from other locations along the Aucilla River (Dunbar et al. 1990; Webb et al. 1984). A few examples of apparently cut and worked megafaunal remains were recovered in our excavations at Page-Ladson, along with possible early PaleoIndian lithic tools.

The issue of whether PaleoIndians coexisted with Pleistocene megafauna in north Florida in general, and at Half-Mile Rise in particular, is beyond the scope of this paper. However, the earliest human use of the area is worth considering because the late Pleistocene/early Holocene strata at Page-Ladson include seeds of

TABLE 2.—Page-Ladson *Cucurbita pepo* contexts.

Total Seeds	Field No.	Provenience	Matrix Type	Collection
2	131	1988 Test C, Zone D	woody-organic clay, upper calcarenite	bulk sediment sample
1	17-A	1991 level 14	woody-organic clay	excavation screen
3	25-A	1991 level 21	woody-organic clay	excavation screen
8	26-A	1991 level 22	woody-organic clay	excavation screen
3	26.2	1991 level 22, southeast corner	woody-organic clay	bulk sediment sample
6	26.3	1991 level 22, southwest corner	woody-organic clay	bulk sediment sample
1	26.4	1991 level 22, northwest corner	woody-organic clay	bulk sediment sample
3	28.4	1991 level 23, northwest corner	woody-organic clay	bulk sediment sample
5	29-A	1991 level 24	woody organics in calcarenite levels	excavation screen
1	29-B	1991 level 24	woody organic in calcarenite	bulk sediment sample
1	30.4	1991 level 25, northwest corner	woody organics in calcarenite	bulk sediment sample
1	32-A	1991 level 26B	red-brown peat/ calcarenite contact	in situ[1]
6	—	unprovenienced	general calcarenite deposits	excavation screen

[1]Seed in association with proboscidean skull.

Cucurbita pepo, a plant that was certainly utilized later by human groups in Florida and the eastern United States. The possibility exists that gourds at Page-Ladson are in some way tied to the earliest human appearance at the site.

Page-Ladson Cucurbita pepo gourd seeds.—Forty-one *Cucurbita pepo* seeds resembling the ornamental gourd *C. pepo* ssp. *ovifera* (Decker 1986, 1988) have been recovered from deposits at Page-Ladson (Table 2). Most come from the late Pleistocene woody-organic clay deposits.

The *Cucurbita pepo* seeds are in excellent condition, with intact, well-preserved margins and seed coats (Fig. 2). The two seeds from F.S. 131, possible mastodon digesta, however, are fragmentary. Marginal hair is essentially absent or in some cases very weakly developed. The tan-brown color and smooth, even, gently curved margins of the Page-Ladson seeds exclude indigenous *Cucurbita okeechobeensis,* the seeds of which have a greenish cast and relatively rough, angular margins.

Mean length for the Page-Ladson *Cucurbita pepo* seeds is 9.87 mm (Standard Deviation = 0.54), with a range of 8.75–11.15 mm (Table 3). The average width at

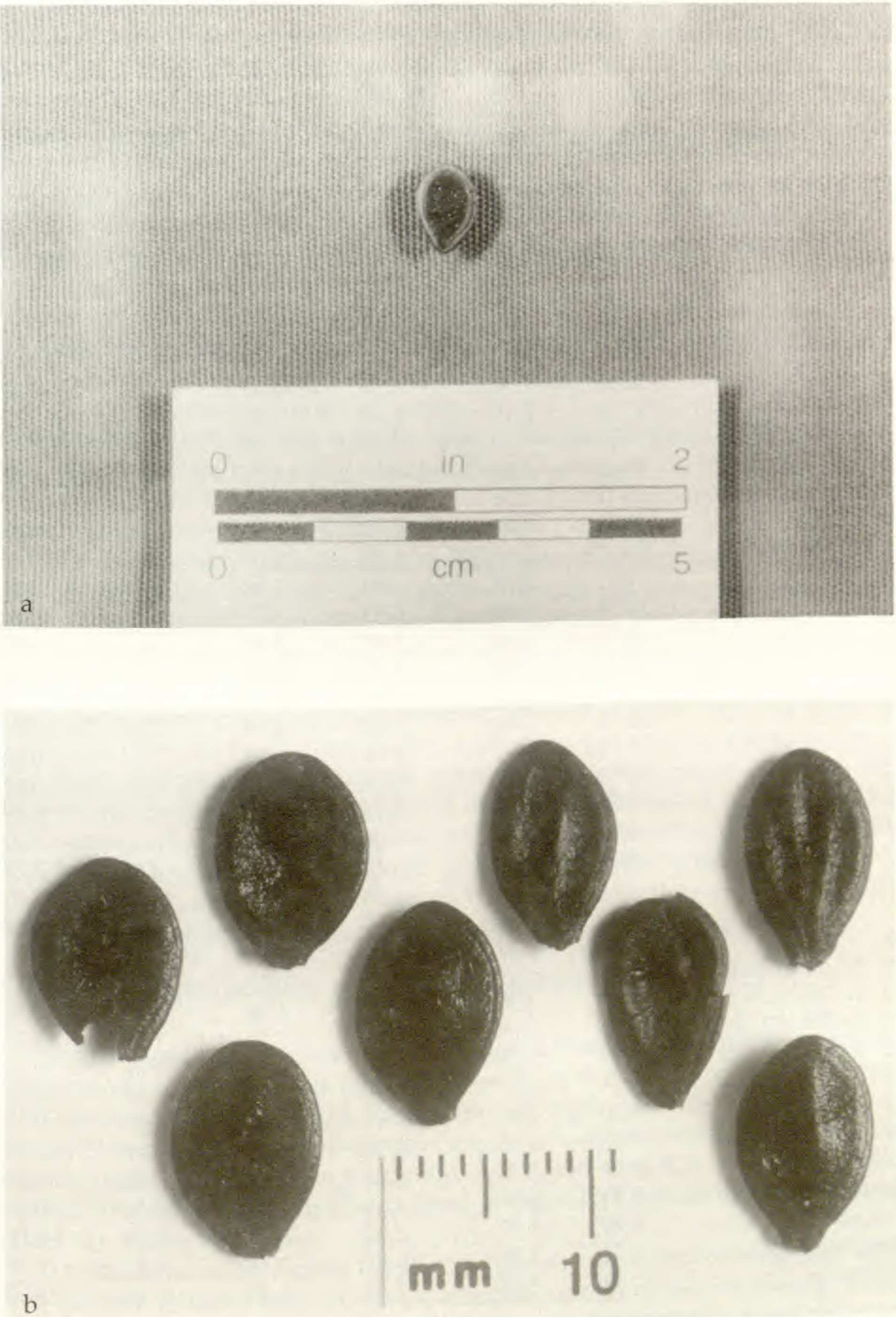

FIG 2.—*Cucurbita pepo* seeds from Page-Ladson: (a) seed from Level 26B, recovered in association with mastodon cranium; (b) seeds from Level 22.

TABLE 3.—Page-Ladson *Cucurbita pepo* seed measurements.[1]

Seed/Provenience		Length	Width			Thickness	W/L[2]
			Proximal	Mid-sect.	Distal		
1	lv. 14, 91.17A	—	—	6.96	4.41	—	—
2	lv. 21, 91.25A	9.48	2.49	6.28	4.42	1.04	0.66
3	lv. 22, 91.26A	9.90	2.70	6.15	5.23	0.50	0.62
4	"	10.05	3.15	7.20	4.80	0.90	0.72
5	"	9.90	2.90	6.15	4.50	0.70	0.62
6	"	10.40	2.45	7.10	5.15	1.20	0.68
7	"	10.15	2.83	7.10	4.80	0.90	0.70
8	"	10.40	2.70	6.30	4.83	1.05	0.61
9	"	10.15	2.15	6.80	4.95	1.05	0.67
10	"	—	—	7.10	5.00	0.90	—
11	lv. 22, 91.26.2	10.46	2.88	6.80	4.51	—	0.65
12	"	9.14	2.36	6.38	4.78	—	0.70
13	"	10.03	2.66	6.45	4.47	—	0.64
14	lv. 22, 91.26.3	10.15	2.65	6.72	5.07	0.55	0.66
15	"	9.11	2.61	6.53	3.68	0.95	0.72
16	"	10.13	2.26	6.17	4.77	1.00	0.61
17	"	8.73	2.00	5.07	3.46	—	0.58
18	"	9.32	2.45	6.47	4.44	—	0.69
19	"	—	2.36	5.95	—	—	—
20	lv. 22, 91.26.4	10.13	2.28	6.43	4.54	0.85	0.63
21	lv. 23, 91.28.4	9.71	1.91	5.94	3.91	—	0.61
22	"	10.03	2.65	6.71	4.48	—	0.67
23	"	8.89	2.84	6.47	4.72	—	0.73
24	lv. 24, 91.29A	9.71	2.49	6.49	4.40	0.63	0.67
25	"	9.97	1.85	6.82	4.72	0.95	0.68
26	"	9.61	2.15	6.86	4.87	0.79	0.71
27	"	10.55	2.37	6.94	5.02	0.42	0.66
28	"	—	2.27	5.64	—	—	—
29	lv. 24, 91.29B	9.35	2.70	7.00	5.25	1.00	0.75
30	lv. 25, 91.30.4	10.40	1.93	7.30	4.50	1.00	0.70
31	lv. 26b, 91.32A	9.60	2.95	6.55	5.20	1.05	0.68
32	level uncertain	9.20	3.00	7.40	5.15	0.90	0.80
33	"	11.15	3.15	7.10	5.50	0.95	0.64
34	"	10.50	2.95	7.60	6.40	1.05	0.72
35	"	9.65	2.35	6.90	5.25	0.70	0.72
AVERAGE		9.87	2.53	6.62	4.76	0.88	0.67
Stand.dev.		0.54	0.35	0.51	0.53	0.19	0.05
Variance		0.29	0.12	0.26	0.28	0.04	0.00
Minimum		8.73	1.85	5.07	3.46	0.42	0.58
Maximum		11.15	3.15	7.60	6.40	1.20	0.80

[1]Measurements in millimeters.

[2]Width to length ratio based on midsection (widest) width. Six fragmentary seeds were not measured: 2 from 1988 sample 131, 2 from lv. 21 no. 91.25A, and 2 without certain provenience.

mid-section is 6.62 mm (S.D. = 0.51; range 5.07-7.60 mm). All specimens are widest at mid-section, with the exception of a single seed from level 22 (seed number 3 in Table 3) that is widest just distal of the mid-section point. Overall length and width values for the Page-Ladson seeds fall within the range for modern ssp. *ovifera*, which includes ornamental gourds, scallop and crookneck squashes (var. *ovifera*), and wild gourds (var. *ozarkana*, var. *texana*) (Cowan and Smith, this volume; Decker 1986, 1988; Decker and Wilson 1986; Decker-Walters et al., this volume). The Page-Ladson seed dimensions, however, fall short of values for ssp. *pepo*, which regularly attain lengths of 12.0 mm and widths of at least 8.0 mm (Decker 1986, 1988; Decker and Wilson 1986). Width and length measurements for the Page-Ladson seeds compare favorably with other prehistoric assemblages of small-seeded *Cucurbita pepo* gourd from Florida (see below).

The Page-Ladson seeds are generally rounded in shape; width to length ratios range from 0.58 to 0.80 (very round) (Table 3). The sample mean, 0.67, agrees with W/L values for ssp. *ovifera* (e.g., Decker 1986; Decker and Newsom 1988; Decker and Wilson 1986). Given their great age, we have not attempted to assign the Page-Ladson seeds to an extant variety.

The coefficient of variation (C.V. = 100 × standard deviation/mean) applied to seed dimensions provides a more precise measure of the degree of morphological variability in a population than is evident using standard deviation alone. The C.V. for length among the Page-Ladson seeds is 5.5. This is relatively low and indicates a rather homogeneous population. The C.V. for width is higher, 8.0. High coefficients of variation may indicate presence of more than one fruit type and/or the initial effects of hybridization, cultivation, and selective breeding (Cowan and Smith, this volume). For example, values for the Phillips Spring site (King 1985; Cowan and Smith, this volume:Table 4) are moderately high (C.V. length = 8.7; C.V. width = 9.1) and have been interpreted, along with other data, as evidence that more than one form of *Cucurbita* gourd was present at that site. Thus, the somewhat smaller coefficients of variation for the Page-Ladson seeds may indicate that fewer, or perhaps a single, variety of gourd was present at the site.

PREHISTORIC *Cucurbita pepo* GOURDS IN FLORIDA

Page-Ladson is the eighth location in Florida from which prehistoric gourd remains similar to *Cucurbita pepo* ssp. *ovifera* have been recovered (Fig. 3). The younger sites range in date from 4000 B.P. to the middle eighteenth century (Table 4). All are wet sites, primarily shell-midden deposits, with abundant, well-preserved organic materials. The recovery of gourd remains in association with fish nets or cordage fragments suggests that at some of these sites gourds functioned as net floats in a fishing tradition.

The seeds from the various Florida sites are very similar morphologically, with well-defined, rounded margins, sparse marginal hair, and gentle narrowing toward the seed sinus region. Occasional seeds have more attenuated curvature toward the sinus area. Thirty-two seeds from Pineland (Table 4) differ by the presence of dense marginal hair, an apparently tomentose seed coat, and rougher, somewhat thicker margins. These seeds are undersized for *Cucurbita moschata*; rather, they give the impression of being a cross between indigenous *C. okeechobeensis* and

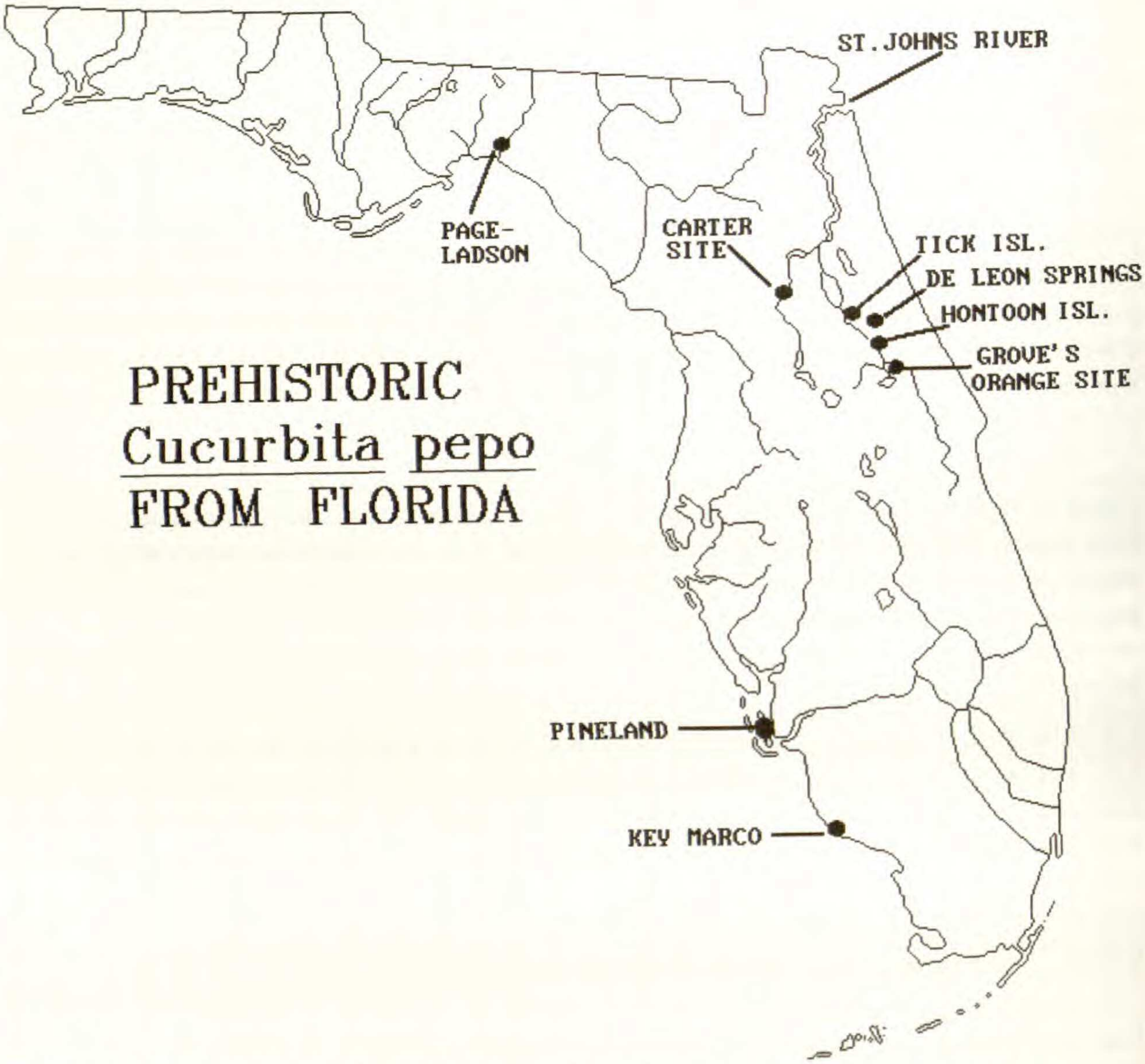

FIG. 3.—Florida archaeological sites with prehistoric *Cucurbita pepo* seeds.

C. pepo ssp. *ovifera*. The distinctive Pineland seeds may represent a previously unrecognized form of *Cucurbita*. For the present purposes, the unusual Pineland seeds are classified as *C. pepo* ssp. *ovifera* with the rest of the Pineland seeds, unless and until further analysis indicates the seeds should be treated separately.

Summary statistics for *Cucurbita pepo* gourd seeds from the Florida sites described above are shown in Table 5; measurements of *Cucurbita pepo* ssp. *ovifera* var. *ovifera* seeds recovered from a sixteenth century well in St. Augustine are included for comparative purposes since these seeds almost certainly represent domesticated plants. Average seed length for the combined populations is 9.43 mm (S.D. = 1.13); average seed width is 6.22 mm (S.D. = 0.45) (Table 5). The coefficients of variation for prehistoric seeds range from relatively low (around 4.0) to moderately high (approaching 10.0). Rather homogenous populations with a narrow range of fruit forms (morphotypes) may be indicated by the relatively low length coefficients of variation (3.0–6.5) for Hontoon Island, Key Marco, Pineland, and as discussed earlier, Page-Ladson (length C.V. 5.5). The corresponding width coefficients for these sites (4.0–10.0) suggest somewhat greater variability.

TABLE 4.—Florida site contexts with *Cucurbita* gourds.

Site	Location	Age	
Page-Ladson (8Je591)	Aucilla River Jefferson Co.	ca. 12,500 B.P.	Webb et al. 1984.
Carter Site (8Mr2061)	Oklawaha River Marion Co.	?early Holocene	Denson et al. 1992.
Tick Island	St. Johns River Volusia Co.	5000-2000 B.P.; & possibly later[1]	Jahn and Bullen 1978; Purdy 1991; Newsom and Purdy 1990.
DeLeon Springs	spring/sinkhole Volusia Co.	ca. 5000 B.P.[2]	Purdy 1991; Newsom and Purdy 1990.
Groves' Orange Midden (8Vo2601)	Lake Monroe (St. Johns Riv) Volusia Co.	4165 B.P. to ca. 500 B.P., possibly later	Russo et al. 1992.
Hontoon Island (8Vo202)	St. Johns River Volusia Co.	3000-200 B.P.	Decker and Newsom 1988; Newsom 1987; Purdy 1991.
Pineland (8LL37)	coastal midden Lee County	ca. 1900 B.P., possibly also as late as 500 B.P.	Marquardt 1992. Walker and Marquardt 1994.
Key Marco	mangrove swamp Collier Co.	1100-1300 B.P.	Cushing 1897; Cutler 1975; Gilliland 1975.
St. Augustine	Spanish well, St. Augustine	16th century	Scarry 1985.

[1]Seeds (3 total) came from a sediment core that penetrated shell midden deposit with Orange and St. Johns Plain ceramics series (ca. 2000 B.C.-A.D. 500 [Milanich and Fairbanks 1980:149]).

[2]Seeds (3) came from a peat core at 10 cm above a dugout canoe with a radiocarbon date of 5140 ± 100 years B.P. (Beta-14893). The canoe rested on limestone bedrock and was buried in the cucurbit-bearing peat; the relationship between the canoe (date) and seeds is uncertain.

Similarities among the coefficients for Hontoon, Key Marco, Pineland, and Page-Ladson—the last almost certainly representing free-ranging gourds—suggest that little or no selective pressures were placed on local gourd populations by human inhabitants of the first three sites. In contrast, values for Groves' Orange Midden (C.V. = 12.0, length; C.V. = 14.0, width) and the length coefficient for the domesticated population from St. Augustine (C.V. = 18.3) are at least twice as high as the values for the other Florida sites. The relatively high values for Groves' Orange Midden reflect the presence of a single seed that is exceptionally large (length 12.79 mm, width 8.41 mm) compared to the rest of the group (Table 5). This large seed, from Level 3, may represent a distinct morphotype, indicating that at least two forms of *Cucurbita pepo* may have been present at the Groves' Orange Midden site (if this seed is excluded, the Groves' Orange Midden coefficients decrease to 6.5 for length and 9.0 for width). Likewise, the extremely high length coefficient of the St. Augustine seeds probably reflects the presence of a more diverse array of *Cucurbita pepo* fruits and/or an expanded genetic base. The St. Augustine seeds derive from cultivated population(s) that undoubtedly included

TABLE 5.—Summary statistics for *Cucurbita pepo* gourd seeds from Florida sites.[1]

		Length				Width				
Seed Population	N	Mean	Range	STD	C.V.	Mean	Range	STD	C.V.	W/L
St. Augustine[2]	15	11.71	9.40–15.65	2.14	18.3	6.86	5.87–7.45	0.34	5.0	0.60
Hontoon Island[3]	1,120	9.09	6.95–11.57	0.54	6.0	6.05	4.22–8.02	0.43	7.0	0.67
Hontoon type-2	26	10.91	10.25–11.57	0.40	4.0	7.46	6.72–7.97	0.35	5.0	0.68
Hontoon type-1	1,094	8.97	6.95–10.70	0.27	3.0	5.96	4.22–8.02	0.23	4.0	0.66
Hontoon-shell	919	9.23	6.95–11.57	0.61	6.6	6.18	4.22–8.02	0.45	7.0	0.67
Hontoon-snail	201	8.88	7.15–10.40	0.30	3.4	5.85	4.22–7.30	0.31	5.0	0.66
Key Marco	48	9.40	8.50–10.52	0.46	5.0	6.37	5.30–7.35	0.50	8.0	0.68
Pineland	98	9.34	7.96–10.84	0.61	6.5	6.32	4.78–7.52	0.63	10.0	0.68
Groves' Orange	11	9.55	7.75–12.79	1.17	12.0	6.54	5.25–8.41	0.92	14.0	0.68
Tick Island	1	10.25				6.22				0.61
DeLeon Springs	2	8.20	7.89– 8.52			5.63				0.69
Carter Site	1	7.50				5.37				0.72
Page-Ladson	35	9.87	8.73–11.15	0.54	5.5	6.62	5.07–7.60	0.51	8.0	0.67
GRAND TOTAL	1,331									
GRAND MEAN		9.43		1.13	12.0	6.22		0.45	7.0	0.67
same w/o TI,DS,CS		9.83		0.87	9.0	6.46		0.25	4.0	0.66
GRAND MEAN[4]		9.12		0.84	9.0	6.12		0.42	7.0	0.67

[1]Measurements in millimeters. STD = Standard deviation; C.V. = coefficient of variation.

[2]The St. Augustine seeds came from a sixteenth century well associated with Spanish-Indian settlement. They probably represent cultivated gourds. Seeds were provided by C.M. Scarry.

[3]Hontoon Type-2 are seeds classified by Decker and Newsom (1988) as *C. pepo* ssp *ovifera* var. *ovifera* (scallop-like seeds); Hontoon Type-1 is the smaller-sized, abundant type from Hontoon Island. Hontoon-shell is the mussel-shell midden that developed primarily during the historic period. Hontoon-snail refers to prehistoric midden composed primarily of freshwater snail. Large "variety *pepo*" seeds from historic period deposits at Hontoon Island (Newsom 1987) were not included in this analysis.

[4]Prehistoric populations only.

domesticated *Cucurbita pepo*, and a gardening situation where hybridization between introduced and native forms of *Cucurbita* was unimpeded by distance or isolation.

For the purposes of this analysis the St. Augustine seeds serve as an archaeological example of domesticated *Cucurbita pepo* gourd, while Page-Ladson, at the other extreme, is representative of wild, free-ranging *Cucurbita*. With these standards, the coefficients of variation may be used indirectly to verify the advent of gardening or the intensification of gardening practices and perhaps human-directed selection for fruit characters at each of the Florida sites (Decker and Newsom 1988:40–42; also see Heiser 1989). By this measure, there is an increase in the length and width coefficients from 3.4 and 5.0, respectively (Table 5), for the prehistoric Hontoon Island snail-shell midden to 6.6 and 7.0, respectively, for the primarily mussel-shell midden that accreted during the latest prehistoric-historic period. This change may track the adoption of gourd cultivation or an intensification of cultivation practices and manipulation of local gourd populations. The appearance of morphologically distinct "type-2" (scallop-type) *Cucurbita pepo* seeds (Decker and Newsom 1988) occurred slightly prior to or in the transition between the two distinctive middens at Hontoon Island. The standard deviations and ranges (length 10.25–11.57; width 6.72–7.97) for the Hontoon Island type-2 seed sample are, however, within the limits of seed size variability for free-ranging gourds as documented by Cowan and Smith (this volume).

FLORIDA GOURD POPULATIONS IN BROADER PERSPECTIVE

It is probable that *Cucurbita pepo* seeds from St. Augustine, and possibly also Hontoon Island type-2 and the large seed from Groves Orange Midden, are archaeological examples of domesticated *Cucurbita pepo*. The older *Cucurbita pepo* gourd remains from other Florida sites help establish the range and variability of seed size, and corroborate other morphological characteristics associated with independent or free-ranging *Cucurbita pepo* gourds. This baseline is important because it provides criteria of seed size and rind character that may be employed in determining which prehistoric gourd populations in eastern North America represent free-ranging and which represent truly domesticated forms of *Cucurbita pepo*, whether introduced or developed *in situ*. Such determinations are necessary to understand the timing and trajectory of indigenous plant husbandry systems.

The data base provided by the Florida seeds is valuable because of its time range—more than 12,500 years—and particularly because the Page-Ladson gourds are unlikely to represent domesticated plants. Thus, we have a paleontological example of what numerical values may be considered representative of clearly wild plants, as opposed to gourds under incipient or full domestication. The sheer quantity of gourd material from Florida is also useful in establishing a reliable base of figures with which to compare other data. This information may then be used in conjunction with data generated from modern and extant free-living gourd populations (Cowan and Smith, this volume; Decker 1986, 1988).

As a general rule, archaeological assemblages in which gourd seed lengths surpass 11.00 mm are considered to represent gourds that have undergone some degree of domestication (King 1985; Cowan and Smith, this volume). Individual seeds with lengths greater than 11.00 mm are absent among the prehistoric *Cucurbita pepo* gourd seed assemblages from Florida, with the exception of a single seed from Page-Ladson (Table 3). All seeds greater than 11.00 mm from Hontoon Island come from historic period deposits; the large seed from Level 3 of the Groves Orange Midden may also be recent, based on the proximity of historic period artifacts. As the 12,500 year old seeds from Page-Ladson almost certainly come from wild gourds, presence of a single seed larger than 11.0 mm at that site underscores the cautionary note by Cowan and Smith (this volume) and others that seed size alone is an unreliable indicator of domesticated status. Likewise, just as the > 11.00 mm length baseline should be applied cautiously when attempting to interpret the timing and scale of domestication, so then should smaller seed sizes not always be equated with the wild state (Cowan and Smith, this volume; Decker and Newsom 1988). Interestingly, some of the smallest seeds from Hontoon Island appear in the latest strata when overall *Cucurbita pepo* seed morphological diversity appears to reach its highest level (Decker and Newsom 1988).

Thus, seed size, to the extent upon which it can be relied, generally places the prehistoric archaeological populations of *Cucurbita pepo* from Florida under the size range (> 11 mm) commonly associated with domesticated forms. By this measure, sixteenth century specimens from St. Augustine, with lengths that attain 15.00 mm, are the only seeds that fit securely within size ranges established for seeds of squash/gourd domesticates.

Rind thickness, rind texture, and peduncle diameter are characteristics that have also been used to assess free-ranging versus domesticated status in *Cucurbita pepo* gourds. The Hontoon Island small-seeded form of *Cucurbita pepo* gourd (Table 5: Hontoon-snail, type-1) is accompanied by smooth-surfaced, thin-shelled rind and peduncles with relatively small basal diameters (Table 6). Mean rind thickness of less than 2 mm and a lack of lobing and/or wartiness are characteristics that researchers have associated with free-living *Cucurbita pepo* gourds (Cowan and Smith, this volume). Rind from the Hontoon Island collection, therefore, being thin and smooth-surfaced, does not differ morphologically from that of wild gourd, at least in any way we can recognize. Furthermore, Cowan and Smith (this volume) have compared basal peduncle diameters (as a direct reflection of relative fruit volume) from free-living and cultivar forms of *Cucurbita pepo* gourd, concluding that peduncle diameters larger than 8 mm are more consistently associated with domesticated status (mean 9.75 mm, range 6.20–15.10 mm). However, Cowan and Smith's data show that free-living forms may approach 9 mm (mean 5.60 mm, range 5.30–8.60 mm). The mean for Hontoon Island peduncle diameters (7.61 mm) is about equidistant between modern free-living and cultivar gourds, but the overall values are generally more similar to the free-living specimens (Table 6). Two peduncle diameters for Pineland are similar. Together, these characteristics (relatively small seeds, thin rinds, small peduncle diameter) demonstrate that the most abundant seed type at Hontoon Island represents a *Cucurbita pepo* gourd that was free-ranging or otherwise displayed no phenotypic alteration that is readily attributed to direct human manipulation.

Whether the larger, type-2 seeds present at Hontoon Island represent a spontaneous mutation from the first type of gourd, intentional selection, or a gourd introduction, is not clear, but there is no associated thicker (> 2 mm) or warty

TABLE 6.—Rind thickness and peduncle diameters for Florida gourd assemblages.[1]

Site	Rind Thickness				Peduncle Diameter		
	N	Mean	Range	STD	N	Mean	Range
Hontoon Island	30	1.08	0.72–1.55	0.22	7	8.15	7.00–9.80
Key Marco	?	—	1.80–2.20	—	0	—	—
Pineland	0	—	—	—	2	8.23	7.43–9.04

[1]Measurements in millimeters.

rind at Hontoon Island indicating a domesticated form of *Cucurbita*. Cutler (1975:256) reported somewhat thicker *Cucurbita pepo* rind for Key Marco (Table 6). Key Marco *Cucurbita* specimens curated at the Florida Museum of Natural History all have smooth rind surfaces, however, like those from Hontoon Island.

Numerical analysis (Decker and Newsom 1988) of a sample of 252 *Cucurbita pepo* gourd seeds from Hontoon Island classifies all specimens within ssp. *ovifera*. Moreover, the small seed type from Hontoon Island exhibits a strong affinity (64% classified) with wild var. *texana*, while larger seeds, including the type-2 scallop specimens, fall within var. *ovifera*. The strong identification with var. *texana* further supports the general impression that Hontoon Island gourds, especially those from prehistoric levels that predate the appearance of the larger-seeded type, were not advanced in the domestication process or at least do not display characteristics generally associated with domestication. The same may be true of the other Florida sites for which the majority of seeds are less than 11 mm in length, but currently there are few or no rinds or peduncles to corroborate the evaluation of domesticated versus free-ranging status utilizing seed length. Moreover, the fact that plant cultivation was of little or no significance throughout most of Florida's prehistory (Milanich 1987; Newsom 1986; 1991, 1993; Scarry and Newsom 1992), further supports the conclusion that prehistoric people in Florida typically made use of free-ranging gourds. Perhaps in some cases a low level of influence was exerted on local gourd populations that is not detected by the measures described above.

It is worth noting that the abundant, small-seeded morphotype from Hontoon Island occurs throughout the stratigraphic sequence at that site and may have survived site abandonment: a few seeds occur in postoccupation levels. The capacity of the gourd to survive without human assistance is additional, albeit inconclusive, evidence of its nondomesticated status. *Cucurbita pepo* gourd remains from Hontoon Island provide the longest, continuous record in Florida for the gourd's presence, extending from a prehistoric deposit of ca. 3000 B.P. to as late as the mid-eighteenth century, based on radiocarbon dates and artifacts of European origin.

The absence of free-ranging gourds along the St. Johns River today is an interesting problem. However, in 1774 William Bartram observed wild gourds growing in the St. Johns River basin (Harper 1958). Although his description may apply to the endemic Okeechobee gourd *(Cucurbita okeechobeensis)* (e.g., Walters and Decker-Walters 1993; Martin 1992), it is possible that what Bartram saw were descendants of the archaeological St. Johns River basin gourds. Bartrum's description of "the wild squash climbing over lofty limbs of the trees; their yellow fruit somewhat of the size and figure of a large orange, pendant from the extremities of the limbs *over the water*" [emphasis added] (Harper 1958:87) possibly applies to *Cucurbita pepo* gourds. Fruit color (yellowish to various shades of tan/brown) and shape (based on the ca. 15-degree angle of curvature) of rind specimens from Hontoon Island are consistent with Bartram's description of a yellow (?dried), roundish, orange-sized fruit. Moreover, 1774 is not far removed from the terminal radiocarbon dates for Hontoon Island: 170 ± 50 B.P. (A.D. 1770), 220 ± 45 B.P. (A.D. 1730), and 260 ± 50 B.P. (A.D. 1680) (Purdy 1987, 1991). The late survival of *Cucurbita pepo* gourds at Hontoon Island, together with Bartram's description of gourds growing somewhere in the vicinity of Lake Dexter, located in the middle river basin only 12 miles north of Hontoon Island, may attest to survival of the archaeological gourd population into relatively recent times. Bartram related to Muhlenberg (Harper 1958:633) that hunters called the gourd "wild squash." The name, coupled with Bartram's description of the habit, implies that the gourds retained characteristics and behaviour associated with the wild state—specifically, the ability to grow and disperse spontaneously, without human intervention. Bartram's portrayal of gourds hanging directly above the river provides a glimpse of how readily fruits could have dispersed along the water course, and supports the suggestion of a long-established pattern of natural dispersal by water routes, as Smith et al. (1992) have hypothesized regarding the niche and expansion of "easternized" *Cucurbita pepo* gourds.

EARLY GOURDS IN FLORIDA AND EASTERN NORTH AMERICA

Middle Holocene *Cucurbita pepo* gourd remains are known from several locations across the eastern United States (Cowan and Smith, this volume; Fritz 1990; King 1985; Smith 1987, 1992; Watson 1989). These remains pre-date the hypothesized 3000–4000 B.P. time frame when gardening and human-induced morphological change in gourd specimens are thought to appear (Smith et al. 1992). Previous to the Page-Ladson discoveries, the earliest (7000 B.P.) remains possibly attributable to *Cucurbita pepo* were from west-central Illinois (Conard et al. 1984; Cowan and Smith, this volume); dates nearly as early come from eastern Tennessee (6990–5300 B.P.) (Crites 1991). Dates of around 4500 B.P. are recorded for south-central Missouri (Kay et al. 1980) and eastern Kentucky (Cowan 1990). Recently, *Cucurbita* sp. rind recovered from a hearth-like feature at the Sharrow Site in Maine (N. Asch Sidell in Petersen 1991) has been directly dated by the accelerator radiocarbon method to 5695 ± 100 B.P. (AA-7491) (James Peterson, personal communication, 1992). The Florida *Cucurbita pepo* gourd identifications thus extend the geographic and temporal records for early gourds. The 12,500 B.P. radiocarbon dates for Page-Ladson push the presence of eastern gourd back into the closing stages of the Pleistocene epoch.

Some previous interpreters of early *Cucurbita pepo*-like gourds in the eastern United States have tended to view them as having been transported from Mexico via down-the-line exchange or similar mechanisms (e.g., discussion summarized in King 1985). Some researchers consider the earliest appearances in the East of

Cucurbita pepo gourd to represent fully-domesticated forms (Asch and Asch 1992; Kirkpatrick and Wilson 1988; cf. Fritz 1990). The Page-Ladson seeds document that an eastern Pleistocene *Cucurbita pepo* gourd may have been growing in Florida prior to the appearance of PaleoIndians, and thus strengthen the case for introduction by natural, rather than by cultural means, as well as presenting the possibility for entry into North America prior to 12,500 B.P.

It is not difficult to envision how Pleistocene *Cucurbita pepo* gourds could have dispersed from an early Mexican origin and center of diversity (Decker-Walters et al., this volume; Nee 1990) to Florida and the eastern United States without the aid of human intervention. Indeed, Decker-Walters et al. (this volume) postulate an ancient range for wild *Cucurbita pepo* that stretched from central or southern Mexico north to the Ozark Plateau and east to the Florida peninsula. Furthermore, the coastal plain and Florida platform were considerably larger in the late Pleistocene, when much lower sea levels exposed vast areas of the now-submerged continental shelf stretching from Florida to Yucatan. The greatly expanded coastal plain, known to paleogeographers as the Gulf Coastal Corridor, became a major migration route for Pleistocene mammals (Morgan 1991; Webb 1989, 1991; Webb and Wilkins 1984), as well as for terrestrial vegetation (Long 1974; Tomlinson 1980). Some 17–34% of successive Pleistocene-neotropical mammalian faunas dispersed through this corridor and became established in the eastern United States (Webb and Wilkins 1984). That proboscideans may have acted as animal vectors for early gourd dispersal has been suggested by other researchers (Janzen and Martin 1982; Nabhan 1987); the possibility that one context for the Page-Ladson seeds is mastodon digesta is especially intriguing in this regard.

Mirroring and perhaps in conjunction with Decker-Walters's (Decker-Walters et al., this volume) hypothetical range expansion of an early *Cucurbita pepo* ancestor, we postulate a natural eastward dispersal of wild *Cucurbita pepo* around the Gulf Coastal Corridor from source areas in Mexico. Heiser (1979, 1989, 1990) and others have discussed how early bottle gourd *(Lagenaria siceraria)* might have first appeared in Florida (7290 $\pm$ 120 B.P. [Doran et al. 1990]) and the eastern United States by water-dispersal along the Gulf Coast from tropical regions. Given the apparently similar adaptation of free-ranging *Cucurbita pepo* (Cowan and Smith, this volume; Smith et al. 1992), we envision, as does Smith (1992:285), the small round gourds being deposited at the mouths of rivers along the Mexican coast and subsequently being transported eastward along the coast by drift and the clockwise flow of the Gulf Stream (Gunn and Dennis 1976; Guppy 1917), to end up at the mouths of other river systems from present-day Texas to Florida. Indeed, a look at distribution maps constructed by Nee (1990:Fig. 2) for wild var. *texana* and other closely related types reveals a strong association with Gulf coastal regions. Once established in the lower basins of easterly rivers, the wild gourds could eventually "migrate" with annual floods, and perhaps also with the aid of large mammalian dispersers, until their populations reached well up into the midwestern United States, culminating in the long-established "easternized" gourd of Smith et al. (1992). The process of natural dispersal and movement of gourds into and around the greater eastern temperate region may have been ongoing for millennia, and eventually aided by human groups who took up the gourds as a useful and edible plant.

The Gulf coast and Florida were cooler than present in the Pleistocene, enough so that at the glacial maximum of ca. 18,000 years B.P. spruce pollen is recorded for northern Florida (Watts and Hansen 1988; Watts et al. 1992). At other times, such as following the peak glacial advance of 18,000 B.P., the Gulf coast was considerably more arid than present, but ambient temperatures were not appreciably lower (Watts and Hansen 1988). Cooler conditions along the Gulf coastal plain may have allowed the tropically-derived Cucurbitaceae to adjust to climatic conditions along the routes of entry into more temperate zones, again facilitating the naturalization ("easternization") of gourd populations.

CONCLUSIONS

At least as early as the terminal Pleistocene, *Cucurbita pepo* gourds dispersed from an early center in Mexico (Decker-Walters et al., this volume; Nee 1990) into Florida and probably elsewhere in the eastern United States. New evidence from the Aucilla River places *Cucurbita pepo* in Florida by 12,500 years ago. The status of early gourd remains in North America has been controversial. The question has been whether *Cucurbita pepo* gourds that pre-date clearly domesticated forms of the plant at eastern North American sites were domesticated plants from Mexico that were introduced by Native Americans, or, in contrast, whether the early *Cucurbita* gourds were an indigenous wild type or types that were long utilized and eventually taken into cultivation and domesticated by native peoples of the eastern woodlands (Fritz 1990; Smith 1987; Watson 1989). The 12,500 year old *Cucurbita pepo* seeds from Page-Ladson arguably pre-date domestication of the species, although the 8000–10,000 B.P. reportedly domesticated specimens from Mexico closely approximate this age (Whitaker et al. 1957; Whitaker and Cutler 1971; cf. Flannery 1973, and Heiser 1989, 1990). The basis for the domesticated status of early Mexican *Cucurbita* remains is unclear, however, and in light of the early material from Florida, is greatly in need of reevaluation. Unless we are ready to consider the possibility of PaleoIndian gardening and plant protection, it seems most plausible to assume that the earliest eastern gourd finds are remains of wild plants.

The growing archaeological record of earlier and more widely distributed *Cucurbita pepo* gourd remains in the East, however, lends increasingly greater support to the interpretation that the plant was present as part of the native flora by the time Native Americans populated eastern North America. Decker-Walters and her colleagues (Decker 1986, 1987, 1988; Decker-Walters et al., this volume) have demonstrated distinct genetic relationships among cultivar forms of *Cucurbita pepo*, modern free-living gourds in the east, and other wild gourds, leading her recently (Decker-Walters et al., this volume) to conclude that gourd populations north of Texas are the result of a long developmental history in relative isolation. Numerical analysis of seeds from Hontoon Island, Florida (Decker and Newsom 1988) produced results that at least superficially link modern ssp. *ovifera*, including a representative wild form, var. *texana*, and archaeological specimens. Thus, it is becoming increasingly more difficult to explain eastern *Cucurbita pepo* and indigenous plant production systems as a function of, or derivative of, borrowed plants and ideas from Mexico. The present evidence better supports the view explicated by Smith (1987) and others (see, for example, Cowan and Smith this volume; Decker 1988; Fritz 1990; Heiser 1989, 1990; Smith et al. 1992; Watson 1989; Whitaker and Carter 1946) that eastern *Cucurbita pepo* gourds are part of the native flora, and that within the sphere of early plant domestication focused on indigenous wild taxa, a separate, eastern United States center of domestication existed for *Cucurbita pepo.*

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BOOK REVIEW

Household Ecology: Economic Change and Domestic Life Among the Kekchi Maya in Belize. Richard R. Wilk. Tucson and London: University of Arizona Press, 1991. $55.00 (clothbound). Pp. xx,280. ISBN 0-8165-1214-0.

It would be difficult to find a more fitting title for this scholarly and very readable book (although "household ecology" is arguably redundant). This is a comprehensive treatment with ten informative figures and 28 tables of data—a reflection of Wilk's familiarity with the study area, the Kekchi people and their interactions with their natural and agricultural ecosystems, themselves and with the so-called "outside world."

The extended preface is informative and it should not be skipped. In the introductory chapter, Wilk gives a brief historical and theoretical background followed by an outline of the book, chapter by chapter: Household social evolution; The household as a unit of analysis; The historical and ethnographic setting; The physical setting; Land tenure and crops; Domestic animals; Hunting and gathering; Economic change; The organization of labor; Households as adaptive groups; and Household history and ecology.

Predictably, this book will hold greater appeal for professional anthropologists than ethnobiologists, and I feel certain the author had the former group in mind as the primary targeted readership. Nonetheless, as a general ethnobotanist, I found the last half of the book, and especially chapters 6 through 9, meaty with concepts and discussions not only interesting but also germane to studies in ethnobiology and I suggest that investigators in this discipline might find ideas to consider in their research.

Although the price of the book will perhaps discourage at least some ethnobiologists from adding it to personal collections, I certainly recommend it as an important acquisition to institutional libraries.

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BOOK REVIEW

Traditional Plant Foods of Canadian Indigenous Peoples: Nutrition, Botany, and Use. Harriet V. Kuhnlein and Nancy J. Turner. Volume 8 in the Food and